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10/615,915	07/10/2003	Yohei Yamazawa	227430US26	9540

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EXAMINER

DHINGRA, RAKESH KUMAR

ART UNIT	PAPER NUMBER
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1763

DATE MAILED: 04/27/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/615,915

Applicant(s)

YAMAZAWA ET AL.

Examiner

Rakesh K. Dhingra

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 03 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 22 February 2006.
- 2a) ☒ This action is FINAL. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1,3,4,6,10-20,26-30 and 41-43 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1,3,4,6,10-20,26-30 and 41-43 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- ☒ Notice of References Cited (PTO-892)
- ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____
- ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____
- ☐ Notice of Informal Patent Application (PTO-152)
- ☐ Other: _____

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DETAILED ACTION

Response to Arguments

Applicant's arguments with respect to independent claims 1, 12, 26 have been considered but are moot in view of the new ground(s) of rejection as explained hereunder.

Applicant has amended claims 1, 12, 26 and added new dependent claims 41-43.

New reference by Raoux et al (US Patent No. 7,004,107) has been found which when combined with Sato et al (US 6,199,505) reads on amended claims 1, 12, 26 limitations. Accordingly independent claims 1, 12, 26 have been rejected under 35 USC 103 (a) as explained below. Further dependent claims 3, 4, 6, 10, 11, 13-20, 27-30 and new claims 41-43 have also been rejected under 35 USC 103 (a) as explained below.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not

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commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

Claims 1, 3, 4, 10-13, 26-29 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sato et al (US Patent No. 6,199,505) in view of Raoux et al (US Patent No. 7,004,107).

Regarding Claim 1: Sato et al teach an apparatus (Figures 1,3) which performs a plasma process on a target substrate 66 by using plasma, comprising:
an airtight process chamber 40a, which accommodates the target substrate;
a gas supply system 52, which supplies a process gas into the process chamber;
an exhaust system 64 (as shown in Figure 1), which exhausts an interior of the process chamber and sets the interior the process chamber to a vacuum state;
first and second electrodes 78, 54a arranged in the process chamber to oppose each other, an RF field which turns the process gas into plasma by excitation being formed between the first and second electrodes;
first and second RF power supplies 86, 62 connected to the first and second electrodes through matching circuits 84, 60 supply RF power, the matching circuits serving g to perform input impedance matching relative to the RF power (Column 4, lines 40-63 and Column 8, lines 5- 50);

Sato et al do not teach an impedance setting section in addition to impedance matching circuit and controller.

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Raoux et al teach a plasma apparatus (Figures 1, 5, 7, 11) that includes high & low frequency power sources 12, 17, high frequency matching unit 13, a processor 85 and impedance setting section (impedance tuner 108 and impedance probe 110) connected through an interconnection to a predetermined member to be electrically coupled to plasma. Raoux et al further teach that the impedance setting section can be configured to set a previously defined value of plasma impedance (would include backward impedance also) and in case of variation the plasma impedance could be adjusted using impedance tuner 108 through a processor 85 (controller) that executes a system control software program stored in memory 86 (column 6, lines 10-25 and column 8, line 62 to column 9, line 40 and column 10, lines 45-65 and column 18, lines 12-62).

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to use impedance setting section (in addition to matching circuit) and a controller as taught by Raoux et al in the apparatus of Sato et al to enable adjust chamber impedance during extended plasma runs in case the impedance value drifts outside a pre-set range (abstract).

Regarding Claims 3, 4: Raoux et al teach that apparatus enables preset control profiles for each process can be stored in the software program in advance and the apparatus results in improved uniformity and stability of the plasma process on the target substrate (Column 9, lines 40-55 and Column 21, line 60 to Column 22, line 15).

Regarding Claim 10: Rouax et al teach that the RF power 17 and impedance tuner 108 are connected to the first electrode 32 through a first interconnection, and the RF

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component includes a harmonic of a fundamental frequency of the RF power (Figure 5, 11 and Column 9, lines 20-65).

Regarding Claim 11: Rouax et al teach the value of the input impedance can be set (configured) and controlled as per process limitation (Column 18, lines 30-65).

Further it has been held in courts (Case Law) as follows:

It would have been obvious to one having ordinary skill in the art to have determined the optimum value of a cause effective variable such as through routine experimentation in the absence of a showing of criticality. *In re Woodruff*, 16 USPQ2d 1934, 1936 (Fed. Cir. 1990).

Regarding Claims 12, 26, 28: Sato et al in view of Rouax et al teach all limitations of the claim (as explained above), including impedance setting using impedance setting section comprising of impedance probe 110, impedance tuner 108 and controller (processor) 85. Further Rouax et al teach that harmonics developed in the plasma can be tuned by suitably adjusting the value of matching capacitor 20 {like part of an impedance setting section} (Figure 1 and Column 9, line 55 to Column 10, line 10).

It would have been obvious to one of ordinary skill in the art at the time of the invention to use external matching circuit (impedance matching section) as taught by Raoux et al in the apparatus of Sato et al to introduce a desirable sputtering component into the deposition process or to tune the nature and concentration of the reactive species in the plasma (Figures 5, 11 and Column 10, lines 1-10).

Regarding Claim 13: Rouax et al teach that the impedance tuner 108 is connected to lower electrode (Figures 5, 11).

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Regarding Claim 27: Rouax et al teach the value of the input impedance can be set (configured) and controlled as per process limitation (Column 18, lines 30-65).

Further it has been held in courts (Case Law) as follows:

It would have been obvious to one having ordinary skill in the art to have determined the optimum value of a cause effective variable such as through routine experimentation in the absence of a showing of criticality. *In re Woodruff*, 16 USPQ2d 1934, 1936 (Fed. Cir. 1990).

Regarding Claim 29: Sato et al teach that frequency of first RF power source 86 is higher (30-300 MHz) than that of second RF power source 62 (0.3 to 30 MHz) [Column 8, lines 30-40).

Claims 6, 16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sato et al (US Patent No. 6,199,505) in view of Raoux et al (US Patent No. 7,004,107) as applied to Claims 1, 12 and further in view of Collins et al (US Patent No. 6,252,354).

Regarding Claims 6, 16: Sato et al in view of Raoux et al teach all limitations of the claim including that variable capacitor of the impedance tuner 108 (Raoux et al) enables impedance to be automatically adjusted (continuously varying element) in response to from impedance probe 110 to enable control impedance.

Raoux et al do not teach impedance control stepwise by switching a plurality of fixed elements.

Collins et al teach an apparatus (Figures 5, 6) that uses plurality of switches 520, 520' which can be closed in different combinations to provide choice of resistive matching

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ranges to facilitate impedance matching and that various inductive and capacitive elements may be fixed or variable (Column 10, line 52 to Column 11, line 37).

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to use stepwise control of impedance as taught by Collins et al in the apparatus of Sato et al in view of Raoux et al to provide further optimization of plasma parameters.

Claim 14 is rejected under 35 U.S.C. 103(a) as being unpatentable over Sato et al (US Patent No. 6,199,505) in view of Rouax et al (US Patent No. 7,004,107) as applied to Claim 12 and further in view of Shan et al (US Pub. No.2001/0009139).

Regarding Claim14: Sato et al in view of Rouax et al teach all limitations of the claim except that predetermined member is focus ring.

Shan et al teach an apparatus (Figure 2) that has matched RF power connected to Process kit (focus ring) 220 [Paragraphs 0029, 0035, 0040].

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to select focus ring as predetermined member as taught by Shan et al in the apparatus of Sato et al in view of Rouax et al to improve plasma uniformity (Paragraph 0011).

Claim 15 is rejected under 35 U.S.C. 103(a) as being unpatentable over Sato et al (US Patent No. 6,199,505) in view of Rouax et al (US Patent No. 7,004,107) as applied to Claim 12 and further in view of Hendricks et al (US Patent No. 4,340,461).

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Regarding Claim 15: Sato et al in view of Rouax et al teach all limitations of the claim except that predetermined member is rectifying (baffle) plate.

Hendericks et al teach an apparatus that has a conductive baffle (rectifying) plate 41 (Figures 1, 2) connected to anode (upper electrode) 3 which is connected to RF power source [Column 4, lines 1-50 and Column 7, lines 39-45]. As already explained above, Sato et al in view of Patrick et al and Parson teach plasma system where one of the electrodes is connected to matching network and impedance setting section with a controller for matching of impedance.

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to use baffle plate as predetermined member and connected to RF source (through one of the electrode-anode) as taught by Hendericks et al in the apparatus of Sato et al in view of Rouax et al to increase process uniformity (Column 6, lines 3-11).

Claims 17-20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sato et al (US Patent No. 6,199,505) in view of Rouax et al (US Patent No. 7,04,107) as applied to Claim 12 and further in view of Hilliker (US Patent No. 6,631, 693).

Regarding Claim 17: Sato et al in view of Rouax et al teach all limitations of the claim except filter in impedance setting unit to resonate at higher harmonics.

Hilliker teaches an apparatus (Filter as per Figures 2, 6) 601 that can allow frequencies of interest (includes higher harmonics) to be delivered to plasma while absorbing unwanted frequencies coming from plasma (Column 8, line 25 to Column 9, line 5).

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Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to use filter circuit as taught by Hilliker in the apparatus of Sato et al in view of Rouax et al to obtain desired process results by using frequencies of interest.

Regarding Claim 18: Hilliker teaches that filter circuits (Figures 1) have a resistance (that is impedance, since reactive component is very low) of 50 ohm to enable dissipate energy at other than desired frequencies (Column 4, lines 26-53).

Regarding Claims 19, 20: Hilliker teaches that Filter circuit 601 (Figure 6) include a high pass filter 631 and a low pass filter 621 which can be set to cut any desired frequency including fundamental frequency component (Column 8, lines 25-67).

Claim 30 is rejected under 35 U.S.C. 103(a) as being unpatentable over Sato et al (US Patent No. 6,199,505) in view of Rouax et al (US patent No. 7,004,107) as applied to Claim 29 and further in view of Nakano et al (US Patent No. 6,270,618).

Regarding Claim 30: Sato et al in view of Rouax et al teach all limitations of the claim except frequency of first RF power being lower than that of second RF power.

Nakano et al teach an apparatus (Figure 11) that has first RF power supply 1 (13.56 MHz) connected to upper electrode 4 and second RF power supply 15 (100 MHz) connected to susceptor 8 and where the system has a band eliminator 61b that can be set to resonance to select only a specific frequency to be supplied to susceptor (Column 1, lines 10-65).

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to use frequency configuration for the electrodes as taught by Nakano et al in

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the apparatus of Sato et al in view of Rouax et al to enable generate plasma as per process limitations.

Claims 41-43 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sato et al (US Patent No. 6,199,505) in view of Rouax et al (US Patent No. 7,004,107) and further in view of Shannon et al (US PG PUB No. 2003/0192475).

Regarding Claims 41-43: Sato et al in view Rouax et al teach all limitations of the claim as explained above including an impedance setting section being configured to set a desired backward impedance value.

Sato et al in view of Rouax et al do not teach a circuit defining the backward impedance to resonate with at least one of higher harmonics.

Shannon et al teach a plasma apparatus (Figures 1-5) that includes a chamber 100, with a RF power supply 132 coupled to lower electrode 110 through a matching network 134. Shannon et al further teach that by using a separate shunt circuit 502/504 coupled to a probe 506 (like an impedance setting section) and by suitably adjusting impedance of related chamber structures like feed line to cooling plate 310, the higher harmonics can resonate and harmonic energy can be shunted to ground (Paragraphs 0020, 0022-0026).

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to use separate circuit for shunting the harmonic energy to ground as taught by Shannon et al in the apparatus of Sato et al in view of Rouax et al to improve plasma uniformity (Paragraph 0026).

Conclusion

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Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a). A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Rakesh K. Dhingra whose telephone number is (571)-272-5959. The examiner can normally be reached on 8:30 -6:00 (Monday - Friday). If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Parviz Hassanzadeh can be reached on (571)-272-1435. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).



Rakesh Dhingra



Parviz Hassanzadeh
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Art Unit 1763